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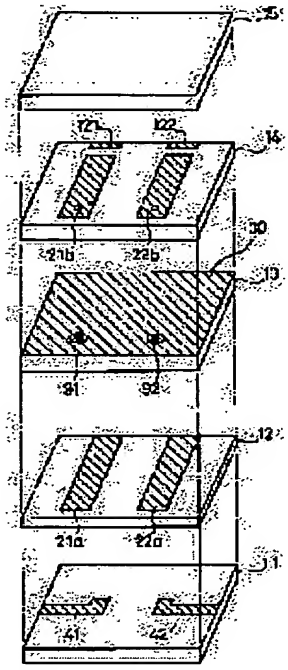
(54) DIELECTRIC FILTER

(57)Abstract:
PURPOSE: To provide a dielectric filter which has a compact structure and a small area occupied for mounting.
CONSTITUTION: The resonant lines 21a and 21b constructing partly a resonant element are set on a dielectric layer 12, and an inner ground electrode 30 is formed on a dielectric layer 13 which is put on the layer 12. The resonance lines 21b and 22b constructing partly the resonant element are set on a dielectric layer 14 which is put on the layer 13. The front end parts of both lines 21a and 21b are connected to each other via a through hole 91 filled with a conductor. Thus a 1/4 wavelength type strip line resonant element is obtained at the input side. Meanwhile the front end parts of both lines 22b and 22a are connected to each other via a through hole 92 filled with a conductor. Thus a 1/4 wavelength type strip line resonant element is obtained at the output side respectively.



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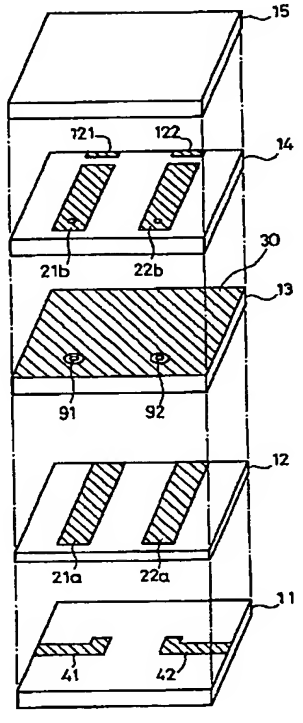
(54)【発明の名称】　誘電体フィルタ

(57)【要約】

【目的】小型化され、実装したときの占有面積が小さな誘電体フィルタを提供する。

【構成】誘電体層１２上に共振素子の一部を構成する共振線路２１ａおよび２１ｂを形成する。誘電体層１２上に積層される誘電体層１３上に内部アース電極３０を形成する。誘電体層１３上に積層される誘電体層１４上に共振素子の一部を構成する共振線路２１ｂおよび２２ｂを形成する。共振線路２１ｂの前端部および共振線路２１ａの前端部が内部に導体が充填されたビアホール９１によって接続されて入力側の１／４波長型ストリップライン共振素子を構成し、共振線路２２ｂの前端部および共振線路２２ａの前端部が内部に導体が充填されたビアホール９２によって接続されて出力側の１／４波長型ストリップライン共振素子を構成する。

FIG.1



【特許請求の範囲】
【請求項１】アース電極間の誘電体中に共振素子が形成されているストリップライン型の誘電体フィルタにおいて、前記共振素子が上下に設けられた２層以上のストリップライン型の共振線路を備えていることを特徴とする誘電体フィルタ。
【請求項２】請求項１記載の誘電体フィルタにおいて、前記共振素子が片端短絡型の共振素子であって、前記共振素子の開放端が存在するアース電極間の誘電体層の厚さが前記共振素子の短絡端が存在するアース電極間の誘電体層の厚さよりも薄いことを特徴とする誘電体フィルタ。
【請求項３】請求項１または２記載の誘電体フィルタにおいて、前記共振素子を構成する２層以上の共振線路のうち、少なくとも１層の共振線路が存在するアース電極間の誘電体層の誘電率が他の層の共振線路が存在するアース電極間の誘電体層の誘電率よりも小さいことを特徴とする誘電体フィルタ。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は誘電体フィルタに関し、特に携帯用電話機等の高周波回路無線機器に利用する高周波回路フィルタやアンテナデュプレクサ等に使用される誘電体フィルタに関する。
【０００２】
【従来の技術】図１８、図１９はそれぞれ本発明者達が案出した誘電体フィルタの模式展開図および斜視図である。
【０００３】この誘電体フィルタにおいては、図１８に示すように、まず、誘電体層１１上に一端部が後記する入力側の共振素子２１の一部に重なる入力用電極４１および一端部が後記する出力側の共振素子２２の一部に重なる出力用電極４２を形成し、誘電体層１１上に積層される誘電体層１６上に一端部が後記するアース電極７０に電気的に接続される１／４波長型ストリップライン共振器からなる共振素子２１および２２を所定の間隔をもって形成し、さらに、一端部がアース電極７０に電気的に接続されかつ他端部が共振素子２１、２２の開放端から所定の距離離れて共振素子２１、２２と対向する電極１２１、１２２を誘電体層１６上に形成して共振素子２１および２２の間を誘導結合させ、誘電体層１６上に誘電体層１５を積層し、その後焼成して図１９に示すような積層体１００を形成する。
【０００４】次に、図１９に示すように、積層体１００の表面、並びに入力端子部６１と出力端子部６２を除いた側面および裏面にアース電極７０を形成し、積層体１００の側面および裏面に形成した入力端子部６１内にアース電極７０から電気的に絶縁され、かつ入力用電極４１に電気的に接続される入力端子５１と、積層体１００の側面および裏面に形成した出力端子部６２内にアース電極７０から電気的に絶縁され、かつ出力用電極４２に電気的に接続される出力端子５２を形成して構成していた。
【０００５】
【発明が解決しようとする課題】しかしながら、このような誘電体フィルタが用いられる携帯用電話機端末等においては、小型化の要求が特に強まっており、それにつれてその内部に用いられる誘電体フィルタも小型化し、その占有面積を小さくすることが強く要求されるようになってきているが、上述した構造の誘電体フィルタにおいては共振素子２１、２２がそれぞれ例えばほぼ１／４波長の長さを同一面内において持つ必要があるために、その占有面積を小さくすることが困難であった。
【０００６】従って、本発明の目的は、小型化され、実装したときの占有面積が小さな誘電体フィルタを提供することにある。
【０００７】
【課題を解決するための手段】本発明によれば、アース電極間の誘電体中に共振素子が形成されているストリップライン型の誘電体フィルタにおいて、前記共振素子が上下に設けられた２層以上のストリップライン型の共振線路を備えていることを特徴とする誘電体フィルタが得られる。
【０００８】
【作用】本発明においては、共振素子が上下に設けられた２層以上のストリップライン型の共振線路を備えているから、共振素子による占有面積を小さくでき、その結果、誘電体フィルタの占有面積を小さくできる。
【０００９】上層の共振線路と下層の共振線路との接続は、誘電体フィルタの側面に設けた接続用電極で行ってもよいし、上層の共振線路と下層の共振線路との間の誘電体層中に設けられその内部に導体を充填したビアホールによって行ってもよいし、上層の共振線路と下層の共振線路との間の誘電体層中に設けられ、その内部には導体は充填しないが、その側面に導体を設けたスルーホールによって行ってもよい。
【００１０】ビアホールやスルーホールによって上層の共振線路と下層の共振線路とを接続すれば、これらによって構成される共振素子は誘電体フィルタの外部に露出することがないので、フィルタ特性に対する外部からの影響を小さくすることができる。また、上層の共振線路と下層の共振線路との接続を、誘電体フィルタの側面に設けた接続用電極で行った場合には、上層の共振線路の前端部と下層の共振線路の前端部とを誘電体フィルタの側面に露出させることになるので、上層の共振線路および下層の共振線路がそれぞれ設けられる誘電体層の共振線路が延在する方向の長さを短くすることができる。
【００１１】共振素子としては、片端を短絡し他端を開放した片端短絡型の共振素子や、両端を開放した両端開放型の共振素子を用いることができる。また、誘電体フ

ィルタとしては、短絡端を同一方向に配置したコムライン型のフィルタや、短絡端を交互に配置したインターデジタル型のフィルタに適用することができる。

【００１２】共振素子として、片端短絡型の共振素子を用いる場合には共振素子の開放端が存在するアース電極間の誘電体層の厚さを共振素子の短絡端が存在するアース電極間の誘電体層の厚さよりも薄くすることによって、共振素子の開放端部分はよりアースに近くなり、共振素子の開放端部分とアース電極との間には静電容量が形成され、この静電容量も共振素子を等価変換したときの並列共振回路の静電容量に付加されることになる。従って、共振周波数を同一とすれば並列共振回路のインダクタンスは小さくてすむことになり、その結果共振素子の長さも短くなり、誘電体フィルタの長さも短くなる。

【００１３】また、共振素子を構成する２層以上の共振線路のうち、少なくとも１層の共振線路が存在するアース電極間の誘電体層の誘電率を他の層の共振線路が存在するアース電極間の誘電体層の誘電率よりも小さくすることによって、誘電率が小さい誘電体層内に存在する共振線路間の結合を大きくすることができるので、設計の自由度を増すことができる。

【００１４】さらに、共振素子として片端短絡型の共振素子を用いる場合には、開放端が存在する誘電体層の誘電率と短絡端が存在する誘電体の誘電率とを異ならせることによって、開放端に近い部分の共振線路の特性インピーダンスと短絡端に近い部分の共振線路の特性インピーダンスとを大きく異ならせることができるから、誘電体フィルタのスプリアス特性を改善することができる。

【００１５】また、本発明はトラップフィルタにも適用でき、この場合の共振素子は、２層以上の共振線路によって構成されるインダクタンス成分と、共振線路と入力端子との間隙で形成される容量成分とによって構成される。

【００１６】

【実施例】以下、本発明の実施例を添付の図面を参照して説明する。

【００１７】図１は、本発明の第１の実施例の模式展開図であり、図２は本実施例の斜視図であり、図３は図２のＸ－Ｘ線断面図である。

【００１８】誘電体層１１上に一端部が後記する入力側の共振線路２１ａの一部に重なる入力用電極４１および一端部が後記する出力側の共振線路２２ａの一部に重なる出力用電極４２を形成する。

【００１９】誘電体層１１上に積層される誘電体層１２上に一端部（後端部）が後記するアース電極７０に電気的に接続され入力側の１／４波長型ストリップライン共振素子の一部を構成する共振線路２１ａおよび一端部（後端部）が後記するアース電極７０に電気的に接続され出力側の１／４波長型ストリップライン共振素子の一部を構成する共振線路２１ｂを所定の間隔をもって形成する。

【００２０】誘電体層１２上に積層される誘電体層１３上に内部アース電極３０を形成する。なお、誘電体層１３には共振線路２１ａおよび後記する共振線路２１ｂを接続するためのビアホール９１および共振線路２２ａおよび後記する共振線路２２ｂを接続するためのビアホール９２が内部アース電極３０とそれぞれ電気的に絶縁されて設けられ、これらのビアホール９１、９２内には導体が充填される。

【００２１】誘電体層１３上に積層される誘電体層１４上に入力側の１／４波長型ストリップライン共振素子の一部を構成する共振線路２１ｂおよび出力側の１／４波長型ストリップライン共振素子の一部を構成する共振線路２２ｂを所定の間隔をもって形成する。共振線路２１ｂおよび共振線路２２ｂの後端部がそれぞれ入力側の１／４波長型ストリップライン共振素子の開放端および出力側の１／４波長型ストリップライン共振素子の開放端である。

【００２２】誘電体層１４上に設けられた共振線路２１ｂの前端部および誘電体層１２上に設けられた共振線路２１ａの前端部が誘電体層１３内に設けられ内部に導体が充填されたビアホール９１によって接続されて入力側の１／４波長型ストリップライン共振素子を構成し、誘電体層１４上に設けられた共振線路２２ｂの前端部および誘電体層１２上に設けられた共振線路２２ａの前端部が誘電体層１３内に設けられ内部に導体が充填されたビアホール９２によって接続されて出力側の１／４波長型ストリップライン共振素子を構成する。

【００２３】さらに、一端部がアース電極７０に電気的に接続されかつ他端部が共振線路２１ｂ、２２ｂの開放端から所定の距離離れて共振線路２１、２２とそれぞれ対向する電極１２１、１２２を誘電体層１４上に形成して入力側の共振素子および出力側の共振素子の間を誘導結合させる。

【００２４】誘電体層１４上に表面にアース電極７０が形成される誘電体層１５を積層して、誘電体層１１、１２、１３、１４および１５を一体に構成し、その後焼成して積層体１００を形成する。

【００２５】次に、図２に示すように、積層体１００の表面、並びに入力端子部６１と出力端子部６２を除いた側面および裏面にアース電極７０を形成し、積層体１００の側面および裏面に形成した入力端子部６１内にアース電極７０および内部アース電極３０から電気的に絶縁され、かつ入力用電極４１に電気的に接続される入力端子５１と、積層体１００の側面および裏面に形成した出力端子部６２内にアース電極７０および内部アース電極３０から電気的に絶縁され、かつ出力用電極４２に電気的に接続される出力端子５２を形成する。

【００２６】以上のようにして構成した本実施例の誘電体フィルタにおいては、１／４波長型共振素子は誘電体

層１２上の共振線路２１ａ、２２ａおよび誘電体層１４上の共振線路２１ｂ、２２ｂによってそれぞれ構成されるから、誘電体フィルタの共振線路２１ａ、２２ａ、２１ｂ、２２ｂの延在方向の長さａが短くなり、従って、実装時の占有面積を小さくできる。また、本実施例においては、誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとを誘電体層１３内に設け導体がその内部に充填されたビアホール９１、９２によってそれぞれ接続しているから、これらによって構成される共振素子は誘電体フィルタの外部に露出することがないので、フィルタ特性に対する外部からの影響を小さくすることができる。

【００２７】次に、本発明の第１の実施例の誘電体フィルタの製造方法について説明する。

【００２８】本誘電体フィルタは共振線路２１ａ、２２ａ、２１ｂ、２２ｂ、電極１２１、１２２、入力用電極４１および出力用電極４２、内部アース電極３０並びにビアホール９１、９２内の導体を完全に誘電体中に内蔵することから、共振線路２１ａ、２２ａ、２１ｂ、２２ｂ、電極１２１、１２２、入力用電極４１および出力用電極４２、内部アース電極３０並びにビアホール９１、９２内の導体には損失の少ない比抵抗の低いものを用いることが望ましく、低抵抗のＡｇ系、若しくはＣｕ系の導体を用いることが好ましい。

【００２９】使用する誘電体としては、信頼性が高く誘電率εγが大きいために小型化が可能となるセラミックス誘電体が好ましい。

【００３０】また、製造方法としては、セラミックス粉末の成形体に導体ペーストを塗布して電極パターンを形成した後、各々の成形体を積層しさらに焼成して緻密化し、導体がその内部に積層された状態でセラミックス誘電体と一体化することが望ましい。

【００３１】Ａｇ系やＣｕ系の導体を使用する場合には、それらの導体の融点が低く、通常の誘電体材料と同時焼成することは困難であるところから、それらの融点（１１００℃以下）よりも低い温度で焼成され得る誘電体材料を用いる必要がある。また、マイクロ波フィルタとしてのデバイスの性格上、形成される並列共振回路の共振周波数の温度特性（温度係数）が±５０ｐｐｍ／℃以下になるような誘電体材料が好ましい。このような誘電体材料としては、例えば、コージェライト系ガラス粉末とTiO_2粉末および$Nd_2Ti_2O_7$粉末との混合物等のガラス系のものや、$BaO-TiO_2-Re_2O_3-Bi_2O_3$系組成（Ｒｅ：レアアース成分）に若干のガラス形成成分やガラス粉末を添加したもの、酸化バリウム－酸化チタン－酸化ネオジウム系誘電体磁気組成物粉末に若干のガラス粉末を添加したものがある。

【００３２】一例として、$BaO-TiO_2-Nd_2O_3-Bi_2O_3$系組成の粉末に$ZnO-B_2O_3-SiO_2$系ガラス粉末を混合し、混合粉末を得た。次いで、この混合粉末に、アクリル系有機バインダー、可塑剤、トルエンおよびアルコール系の溶剤を加え、アルミナ玉石で充分に混合してスラリーとした。そして、このスラリーを用いて、ドクターブレード法により、０．２ｍｍ～０．５ｍｍの厚みのグリーンシートを作成した。

【００３３】次に、上記第１の実施例の場合は、銀ペーストを導体ペーストとして図１に示した導体パターンをそれぞれ印刷し、次いで、これら導体パターンが印刷されたグリーンシートの厚みを調整するため必要なグリーンシートを重ねて図１の構造となるように重ね、積層した後、９００℃で焼成して、積層体１００を得た。焼成後の誘電体の比誘電率εｒは８０であった。

【００３４】上記のように構成した積層体１００の上面、すなわち誘電体層１５の全表面対応面、ならびに入力端子部６１、出力端子部６２を除く側面および底面に図２に示すように銀電極からなるアース電極７０を印刷し、さらにアース電極７０から電気的に絶縁し、かつ入力用電極４１、出力用電極４２に各別に電気的に接続する銀電極を入力端子部６１、出力端子部６２内に入力端子５１、出力端子５２として印刷し、印刷した電極を８５０℃で焼きつけて本実施例の誘電体フィルタを形成した。

【００３５】本実施例においては、共振素子の開放端が存在する誘電体層Ａの厚さおよび共振素子の短絡側が存在する誘電体層Ｂの厚さは同一であり、それぞれ２ｍｍあった。また、誘電体フィルタの共振線路２１ａ、２２ａ、２１ｂ、２２ｂの延在方向の長さａは３．５ｍｍであり、誘電体フィルタの幅ｂは５ｍｍであり、中心周波数は１８００ＭＨｚであった。

【００３６】比較のために、図１８、１９に示した誘電体フィルタを本実施例に使用した材料を用いて本実施例と同様な方法で形成した。この場合には、誘電体フィルタの共振素子の延在方向の長さａは６ｍｍ、誘電体フィルタの幅ｂは５ｍｍ、厚さは２ｍｍであり、中心周波数は１８００ＭＨｚであった。この結果と第１の実施例の誘電体フィルタの寸法を比較すれば、第１の実施例の誘電体フィルタの厚さは厚いが、共振素子の延在方向の長さａは短く、従って、実装時における誘電体フィルタの占有面積も小さくなっていることがわかる。

【００３７】次に、本発明の第２の実施例について説明する。

【００３８】図４は、本発明の第２の実施例の模式展開図であり、図５は本実施例の斜視図であり、図６は図５のＸ－Ｘ線断面図である。

【００３９】上記第１の実施例においては、共振線路２１ａ、２１ｂによって構成される入力側の共振素子および共振線路２２ａ、２２ｂによって構成される出力側の共振素子は片側短絡型の共振素子であったが、本実施例においては、共振線路２１ａ、２１ｂによって構成される入力側の共振素子および共振線路２２ａ、２２ｂによ

って構成される出力側の共振素子が両端開放型の共振素子である点が第１の実施例と異なるが、他の構成は上記第１の実施例と同様である。

【００４０】本実施例においても、共振素子は誘電体層１２上の共振線路２１ａ、２２ａおよび誘電体層１４上の共振線路２１ｂ、２２ｂによってそれぞれ構成されるから、誘電体フィルタの共振線路２１ａ、２２ａ、２１ｂ、２２ｂの延在方向の長さａが短くなり、従って、実装時の占有面積を小さくできる。また、本実施例においても、誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとを誘電体層１３内に設け導体がその内部に充填されたビアホール９１、９２によってそれぞれ接続しているから、これらによって構成される共振素子は誘電体フィルタの外部に露出することがないので、フィルタ特性に対する外部からの影響を小さくすることができる。

【００４１】本実施例においても、第１の実施例に使用した材料と同じものを使用し、第１の実施例と同一の方法で誘電体フィルタを作成した。その結果、共振素子の開放端が存在する誘電体層の厚さＡおよび共振素子の短絡側が存在する誘電体層の厚さＢは同一であり、それぞれ２ｍｍあった。また、誘電体フィルタの共振線路２１ａ、２２ａ、２１ｂ、２２ｂの延在方向の長さａは３．５ｍｍであり、誘電体フィルタの幅ｂは５ｍｍであり、中心周波数は９００ＭＨｚであった。

【００４２】次に、本発明の第３の実施例について説明する。

【００４３】図７は、本発明の第３の実施例の模式展開図であり、図８は本実施例の斜視図であり、図９は図８のＸ－Ｘ線断面図である。

【００４４】上記第１の実施例においては、共振素子の開放端が存在する誘電体層Ａの厚さおよび共振素子の短絡側が存在する誘電体層Ｂの厚さを同一とし、さらに、誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとを誘電体層１３内に設け導体がその内部に充填されたビアホール９１、９２によってそれぞれ接続したが、本実施例においては、共振素子の開放端が存在する誘電体層Ａの厚さを共振素子の短絡側が存在する誘電体層Ｂの厚さよりも薄くするとともに誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとを積層体１００の側面に設けた接続用電極８１、８２によってそれぞれ接続した点が第１の実施例と異なるが、他の構成は上記第１の実施例と同様である。

【００４５】本実施例において、共振素子の開放端が存在する誘電体層Ａの厚さを共振素子の短絡側が存在する誘電体層Ｂの厚さよりも薄くすることによって、共振素子の開放端部分はよりアースに近くなり、共振素子の開放端部分とアース電極との間には静電容量が形成され、この静電容量も共振素子を等価変換したときの並列共振回路の静電容量に付加されることになる。従って、共振周波数を同一とすれば並列共振回路のインダクタンスは小さくてすむことになり、その結果共振素子の長さも短くなり、誘電体フィルタの長さも短くなる。

【００４６】また、本実施例においては、誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとを積層体１００の側面に設けた接続用電極８１、８２によってそれぞれ接続しているから、誘電体層１２上の共振線路２１ａ、２２ａの前端部と誘電体層１４上の共振線路２１ｂ、２２ｂの前端部とを誘電体フィルタの側面に露出させることになるので、共振線路２１ａ、２２ａおよび共振線路２１ｂ、２２ｂが設けられる誘電体層１２、１４の共振線路が延在する方向の長さを短くすることができる。

【００４７】本実施例においては、積層体１００の前側面に誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとをそれぞれ接続するための接続用電極８１、８２を設けるから、この接続用電極８１、８２がアースされるのを避けるために誘電体層１３上に設けられる内部アース電極１３は誘電体層１３の前端部までは延在させていない。

【００４８】次に、本実施例の誘電体フィルタの製造方法について説明する。本実施例においても、第１の実施例において使用したグリーンシートを用い、銀ペーストを導体ペーストとして図７に示した導体パターンをそれぞれ印刷し、次いで、これらに導体パターンが印刷されたグリーンシートの厚みを調整するために必要なグリーンシートを重ねて図７の構造となるように積層した後、９００℃で焼成して積層体１００を形成した。

【００４９】上記のように構成した積層体１００の上面、すなわち誘電体層１５の全表面対応面、ならびに入力端子部６１、出力端子部６２を除く左右側面、後側面および底面に図２に示すように銀電極からなるアース電極７０を印刷し、また、アース電極７０から電気的に絶縁し、かつ入力用電極４１、出力用電極４２に各別に電気的に接続する銀電極を入力端子部６１、出力端子部６２内に入力端子５１、出力端子５２として印刷し、さらに、積層体１００の前側面に誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとをそれぞれ接続する接続用電極８１、８２を印刷し、印刷した電極を８５０℃で焼きつけて本実施例の誘電体フィルタを形成した。

【００５０】本実施例においては、共振素子の開放端が存在する誘電体層Ａの厚さは共振素子の短絡側が存在する誘電体層Ｂの厚さよりも薄く、それぞれ０．５ｍｍ、１．６ｍｍあった。また、誘電体フィルタの共振線路２１ａ、２２ａ、２１ｂ、２２ｂの延在方向の長さａは２．５ｍｍであり、誘電体フィルタの幅ｂは５ｍｍであり、中心周波数は１８００ＭＨｚであった。

【００５１】本実施例においては、誘電体フィルタの共

振素子の延在方向の長さａを第１の実施例よりも短くでき、より小型化された誘電体フィルタが得られた。

【００５２】次に、本発明の第４の実施例について説明する。

【００５３】図１０は、本発明の第４の実施例の模式展開図であり、図１１は本実施例の斜視図であり、図１２は図１１のＸ－Ｘ線断面図である。

【００５４】上記第１の実施例においては、共振素子の開放端が存在する誘電体層Ａの厚さおよび共振素子の短絡側が存在する誘電体層Ｂの厚さを同一とし、さらに、誘電体層１４上に共振線路２１ｂ、２２ｂに加えて一端部がアース電極７０に電気的に接続されかつ他端部が共振線路２１ｂ、２２ｂの開放端から所定の距離離れて共振線路２１、２２とそれぞれ対向する電極１２１、１２２を設けたが、本実施例においては、共振素子の開放端が存在する誘電体層Ａの厚さを共振素子の短絡側が存在する誘電体層Ｂの厚さよりも薄くするとともに誘電体層１４上には電極１２１、１２２を設けず共振線路２１ｂ、２２ｂのみを設けた点が第１の実施例と異なるが、他の構成は上記第１の実施例と同様である。

【００５５】本実施例においても、共振素子の開放端が存在する誘電体層Ａの厚さを共振素子の短絡側が存在する誘電体層Ｂの厚さよりも薄くすることによって、共振素子の開放端部分はよりアースに近くなり、共振素子の開放端部分とアース電極との間には静電容量が形成され、この静電容量も共振素子を等価変換したときの並列共振回路の静電容量に付加されることになる。従って、共振周波数を同一とすれば並列共振回路のインダクタンスは小さくてすむことになり、その結果共振素子の長さも短くなり、誘電体フィルタの長さも短くなる。

【００５６】本実施例においても、第１の実施例に使用した材料と同じものを使用し、第１の実施例と同一の方法で誘電体フィルタを作成した。その結果、共振素子の開放端が存在する誘電体層Ａの厚さは０．５ｍｍであり、共振素子の短絡側が存在する誘電体層Ｂの厚さは１．６ｍｍであった。また、誘電体フィルタの共振線路２１ａ、２２ａ、２１ｂ、２２ｂの延在方向の長さａは３．０ｍｍであり、誘電体フィルタの幅ｂは５ｍｍであり、中心周波数は１８００ＭＨｚであった。

【００５７】本実施例においては、誘電体フィルタの共振素子の延在方向の長さａを第１の実施例よりも短くでき、より小型化された誘電体フィルタが得られた。

【００５８】また、本実施例においては、誘電体層１２上の共振線路２１ａ、２２ａと誘電体層１４上の共振線路２１ｂ、２２ｂとを誘電体層１３内に設け導体がその内部に充填されたビアホール９１、９２によってそれぞれ接続しているから、誘電体フィルタの共振素子の延在方向の長さａは第３の実施例よりも若干長くなったが、共振線路２１ａ、２２ａ、２１ｂ、２２ｂおよびビアホール９１、９２によって構成される共振素子は誘電体フィルタの外部に露出することがないので、フィルタ特性に対する外部からの影響を小さくすることができる。

【００５９】次に、本発明の第５の実施例について説明する。

【００６０】本実施例の誘電体フィルタの構造は図７、８、９を参照して説明した第３の実施例と同じであるが、使用した誘電体材料が多少異なっている。

【００６１】すなわち、本実施例においても、共振素子の開放端が存在する誘電体層Ａの厚さを共振素子の短絡側が存在する誘電体層Ｂの厚さよりも薄くする点は第３の実施例と同じであるが、共振素子の開放端が存在する誘電体層Ａには第３の実施例に使用した誘電体材料と同じ材料である$BaO-TiO_2-Nd_2O_3-Bi_2O_3$系組成の粉末に$ZnO-B_2O_3-SiO_2$系ガラス粉末を混合した混合粉末を用いたグリーンシートを使用するが共振素子の短絡端が存在する誘電体層Ｂには$BaO-TiO_2-ZnO$系組成の粉末に$ZnO-B_2O_3-SiO_2$系ガラスを混合した混合粉末を用いたグリーンシートを使用して、共振素子の開放端が存在する誘電体層Ａの誘電率よりも共振素子の短絡端が存在する誘電体層Ｂの誘電率の方を小さくする点が第３の実施例と異なっている。

【００６２】なお、本実施例のように、一つの誘電体フィルタ中に異なった誘電体材料を用いる場合には、焼成後のそりや曲りを回避するために、誘電体層Ａに使用するグリーンシートおよび誘電体層Ｂに使用するグリーンシートの焼成時の収縮率が大きく異ならないようにすることが好ましい。

【００６３】次に、本実施例の誘電体フィルタの製造方法について説明する。本実施例においては、上述した２種類のグリーンシートを用い、銀ペーストを導体ペーストとして図７に示した導体パターンをそれぞれ印刷し、次いで、これらに導体パターンが印刷されたグリーンシートの厚みを調整するために必要なグリーンシートを重ねて図７の構造となるように積層した後、９００℃で焼成して積層体１００を形成した。焼成後の誘電体層Ａの比誘電率は８０であり、誘電体層Ｂの比誘電率は３２であり、共振素子の開放端が存在する誘電体層Ａの誘電率よりも共振素子の短絡端が存在する誘電体層Ｂの誘電率の方が小さかった。

【００６４】このようにして形成した誘電体フイルタにおいて、共振素子の開放端が存在する誘電体層Ａの厚さは０．５ｍｍであり、共振素子の短絡側が存在する誘電体層Ｂの厚さは１．６ｍｍであった。また、誘電体フィルタの共振線路２１ａ、２２ａ、２１ｂ、２２ｂの延在方向の長さａは３．０ｍｍであり、誘電体フィルタの幅ｂは５ｍｍであり、中心周波数は１８００ＭＨｚであった。

【００６５】本実施例においても、誘電体フィルタの共振素子の延在方向の長さａを短くでき、より小型化され

た誘電体フィルタが得られた。

【００６６】また、本実施例においては、共振素子の短絡端が存在する誘電体層Ｂの誘電率を小さくしたから共振素子間の結合が強くなり、より広帯域化された誘電体フィルタが得られた。

【００６７】さらに、本実施例においては、共振素子の開放端が存在する誘電体層Ａは誘電率が大きく、誘電体層の厚さは薄いのに対して、共振素子の短絡端が存在する誘電体層Ｂは誘電率が小さく、誘電体層の厚さは厚いから、共振素子の開放端側の特性インピーダンスは短絡端側の特性インピーダンスよりも小さくなり誘電体フィルタのスプリアス特性も改善できた。

【００６８】次に、本発明の第６の実施例について説明する。上記第１乃至第４の実施例においては、本発明を共振素子間の結合を利用したバンドパスフィルタに適用した場合について説明したが、本実施例においては誘電体トラップフィルタに適用した場合について説明する。

【００６９】図１３は、本発明の第６の実施例の模式展開図であり、図１４は本実施例の斜視図であり、図１５は図１４のＸ－Ｘ線断面図である。

【００７０】誘電体層１２上にインダクタンス成分の一部を構成する共振線路２３ａおよび共振線路２３ａと誘電体層を挟んで容量成分を構成する入力端子５３を形成する。なお、共振線路２３ａの後端部が後記するビアホール９３内の導体によって後記する共振線路２３ｂの後端部と接続される。

【００７１】誘電体層１２上に積層される誘電体層１３上に内部アース電極３０を形成する。なお、誘電体層１３には共振線路２３ａおよび後記する共振線路２３ｂを接続するためのビアホール９３が内部アース電極３０と電気的に絶縁されて設けられ、このビアホール９３内には導体が充填される。

【００７２】誘電体層１３上に積層される誘電体層１４上に共振線路２３ａとともにインダクタンス成分を形成する共振線路２３ｂを形成する。共振線路２３ｂの後端部がビアホール９３内の導体によって共振線路２３ａの後端部と接続され、共振線路２３ｂの前端部が後記するアース電極７０と接続される。

【００７３】誘電体層１４上に表面にアース電極７０が形成される誘電体層１５を積層して、誘電体層１２、１３、１４および１５を一体に構成し、その後焼成して積層体１００を形成する。

【００７４】次に、図１４、図１５に示すように、積層体１００の上面、並びに前面を除いた側面および入力端子部を除いた裏面にアース電極７０を形成し、積層体１００の前面に、アース電極７０および共振素子２３ｂの前端部および内部アース電極３０の前端部とそれぞれ接続されるアース電極７１並びにアース電極７０と電気的に絶縁されかつ入力端子５３に電気的に接続される入力端子５４を形成し、積層体１００の裏面にアース電極７０と電気的に絶縁されかつ入力端子５４に電気的に接続される入力端子５５を形成する。

【００７５】図１６は本実施例の誘電体トラップフィルタの等価回路図を示したものである。インダクタンス成分２１２は共振線路２３ａおよび２３ｂによって構成され、容量成分２１１は共振線路２３ａの前端部と入力端子５３との間隙によって構成されている。このようにして構成されたフィルタは、図１７に示すような周波数特性を示し、このフィルタを回路中に付加することにより特定の周波数信号を大きく減衰させることができる。

【００７６】以上のようにして構成した本実施例の誘電体トラップフィルタにおいては、インダクタンス成分２１２は誘電体層１２上の共振線路２３ａおよび誘電体層１４上の共振線路２３ｂによって構成されるから、誘電体フィルタの共振線路２３ａ、２３ｂの延在方向の長さが短くなり、従って、実装時の占有面積を小さくできる。また、本実施例においても、誘電体層１２上の共振線路２３ａと誘電体層１４上の共振線路２３ｂとを誘電体層１３内に設け導体がその内部に充填されたビアホール９３によってそれぞれ接続しているから、これらによって構成される共振線路は誘電体フィルタの外部に露出することがないので、フィルタ特性に対する外部からの影響を小さくすることができる。

【００７７】次に、本実施例の誘電体フィルタの製造方法について説明する。本実施例においても、第１の実施例において使用したグリーンシートを用い、銀ペーストを導体ペーストとして図１３に示した導体パターンをそれぞれ印刷し、次いで、これらに導体パターンが印刷されたグリーンシートの厚みを調整するために必要なグリーンシートを重ねて図１３の構造となるように積層した後、９００℃で焼成して積層体１００を形成した。

【００７８】上記のように構成した積層体１００の上面、並びに前面を除いた側面および入力端子部を除いた裏面に図１４、図１５に示すように銀電極からなるアース電極７０を印刷し、また、積層体１００の前面に、アース電極７０および共振素子２３ｂの前端部および内部アース電極３０の前端部とそれぞれ接続される銀電極をアース電極７１として並びにアース電極７０と電気的に絶縁されかつ入力端子５３に電気的に接続される銀電極を入力端子５４としてそれぞれ印刷し、積層体１００の裏面にアース電極７０と電気的に絶縁されかつ入力端子５４に電気的に接続される銀電極を入力端子５５として印刷し、印刷した電極を８５０℃で焼きつけて本実施例の誘電体フィルタを形成した。

【００７９】

【発明の効果】本発明においては、共振素子が上下に設けられた２層以上のストリップライン型の共振線路を備えているから、共振素子による占有面積を小さくでき、その結果、誘電体フィルタの占有面積を小さくできる。

【００８０】共振素子として、片端短絡型の共振素子を

用いる場合には共振素子の開放端が存在するアース電極間の誘電体層の厚さを共振素子の短絡端が存在するアース電極間の誘電体層の厚さよりも薄くすることによって、共振素子の開放端部分はよりアースに近くなり、共振素子の開放端部分とアース電極との間には静電容量が形成され、この静電容量も共振素子を等価変換したときの並列共振回路の静電容量に付加されることになる。従って、共振周波数を同一とすれば並列共振回路のインダクタンスは小さくてすむことになり、その結果共振素子の長さも短くなり、誘電体フィルタの長さも短くなる。

【００８１】また、共振素子を構成する２層以上の共振線路のうち、少なくとも１層の共振線路が存在するアース電極間の誘電体層の誘電率を他の層の共振線路が存在するアース電極間の誘電体層の誘電率よりも小さくすることによって、誘電率が小さい誘電体層内に存在する共振線路間の結合を大きくすることができるので、設計の自由度を増すことができる。

【００８２】さらに、共振素子として片端短絡型の共振素子を用いる場合には、開放端が存在する誘電体層の誘電率と短絡端が存在する誘電体の誘電率とを異ならせることによって、開放端に近い部分の共振線路の特性インピーダンスと短絡端に近い部分の共振線路の特性インピーダンスとを大きく異ならせることができるから、誘電体フィルタのスプリアス特性を改善することができる。

【図面の簡単な説明】

【図１】本発明の第１の実施例の積層型誘電体フィルタを説明するための模式展開図である。

【図２】本発明の第１の実施例の積層型誘電体フィルタを説明するための斜視図である。

【図３】図２のＸ－Ｘ線断面図である。

【図４】本発明の第２の実施例の積層型誘電体フィルタを説明するための模式展開図である。

【図５】本発明の第２の実施例の積層型誘電体フィルタを説明するための斜視図である。

【図６】図５のＸ－Ｘ線断面図である。

【図７】本発明の第３および第５の実施例の積層型誘電体フィルタを説明するための模式展開図である。

【図８】本発明の第３および第５の実施例の積層型誘電体フィルタを説明するための斜視図である。

【図９】図８のＸ－Ｘ線断面図である。

【図１０】本発明の第４の実施例の積層型誘電体フィルタを説明するための模式展開図である。

【図１１】本発明の第４の実施例の積層型誘電体フィルタを説明するための斜視図である。

【図１２】図１１のＸ－Ｘ線断面図である。

【図１３】本発明の第６の実施例の積層型誘電体フィルタを説明するための模式展開図である。

【図１４】本発明の第６の実施例の積層型誘電体フィルタを説明するための斜視図である。

【図１５】図１４のＸ－Ｘ線断面図である。

【図１６】本発明の第６の実施例の積層型誘電体フィルタの等価回路図である。

【図１７】本発明の第６の実施例の積層型誘電体フィルタの周波数特性を説明するための図である。

【図１８】本発明者達が案出した従来の誘電体フィルタを説明するための模式展開図である。

【図１９】本発明者達が案出した従来の誘電体フィルタを説明するための斜視図である。

【符号の説明】

１１～１６…誘電体層

２１ａ、２１ｂ、２２ａ、２２ｂ、２３ａ、２３ｂ…共振線路

２１、２２…共振素子

３０…内部アース電極

４１…入力用電極

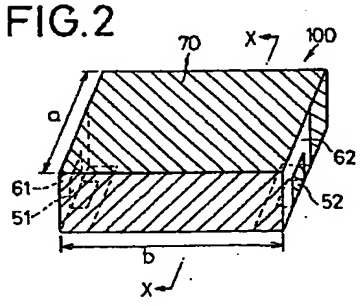
４２…出力用電極

５３～５５…出力端子

７０、７１…アース電極

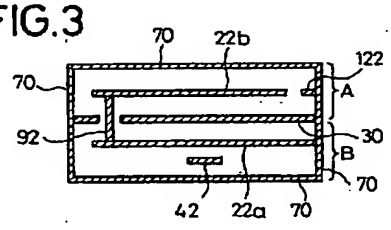
【図２】

FIG.2



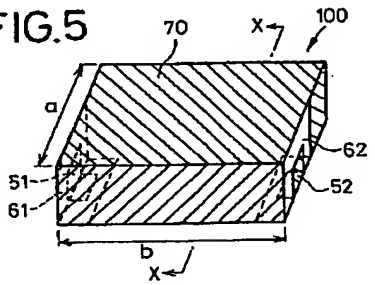
【図３】

FIG.3



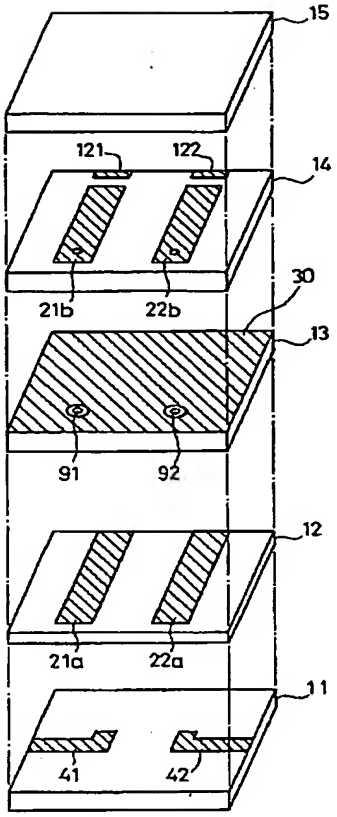
【図５】

FIG.5



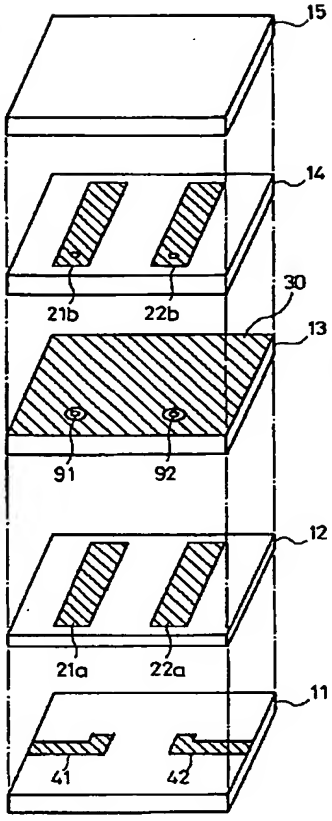
【図１】

FIG.1



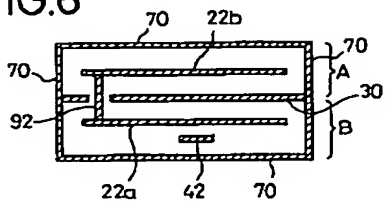
【図４】

FIG.4



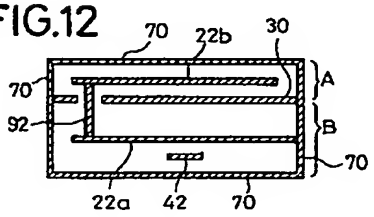
【図６】

FIG.6



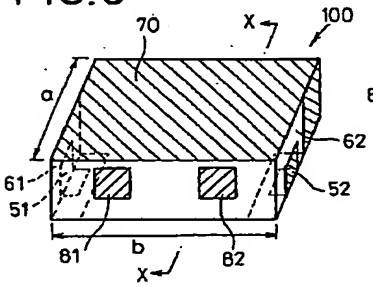
【図１２】

FIG.12



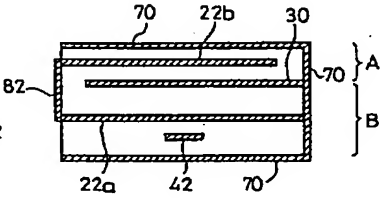
【図８】

FIG.8



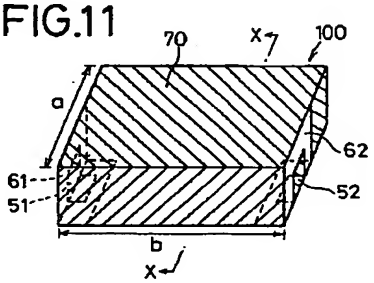
【図９】

FIG.9



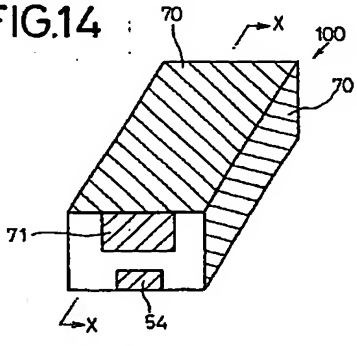
【図１１】

FIG.11



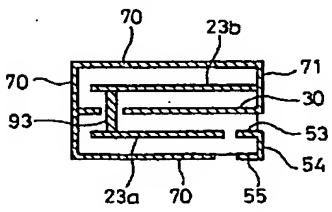
【図１４】

FIG.14



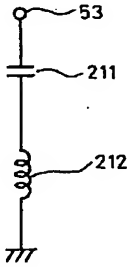
【図１５】

FIG.15



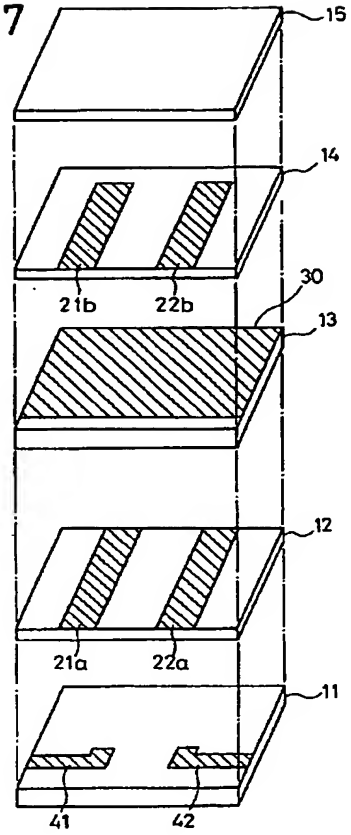
【図１６】

FIG.16



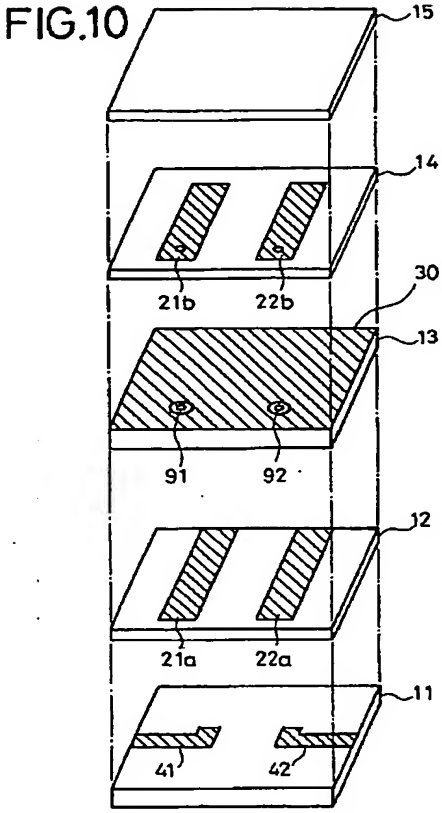
【図７】

FIG.7



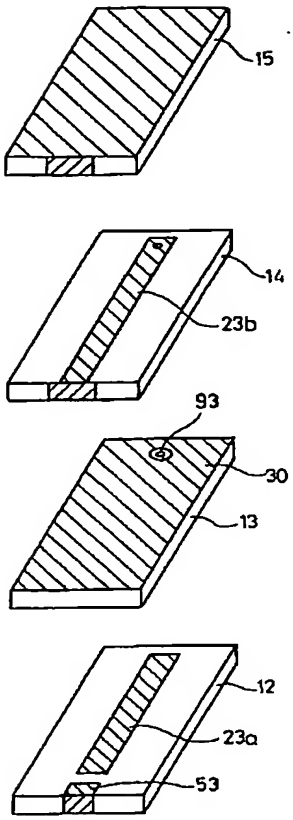
【図１０】

FIG.10



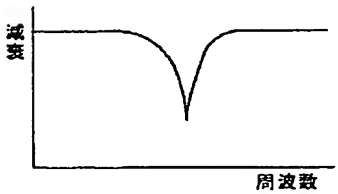
【図１３】

FIG.13



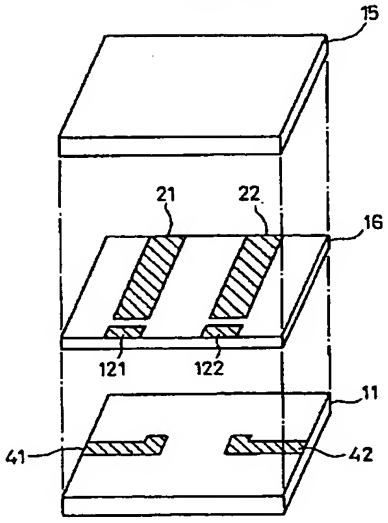
【図１７】

FIG.17



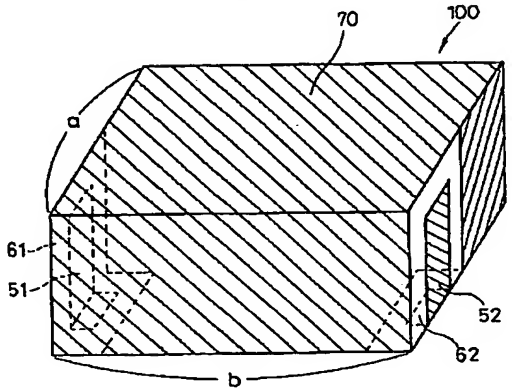
【図１８】

FIG.18



【図１９】

FIG.19



* NOTICES *

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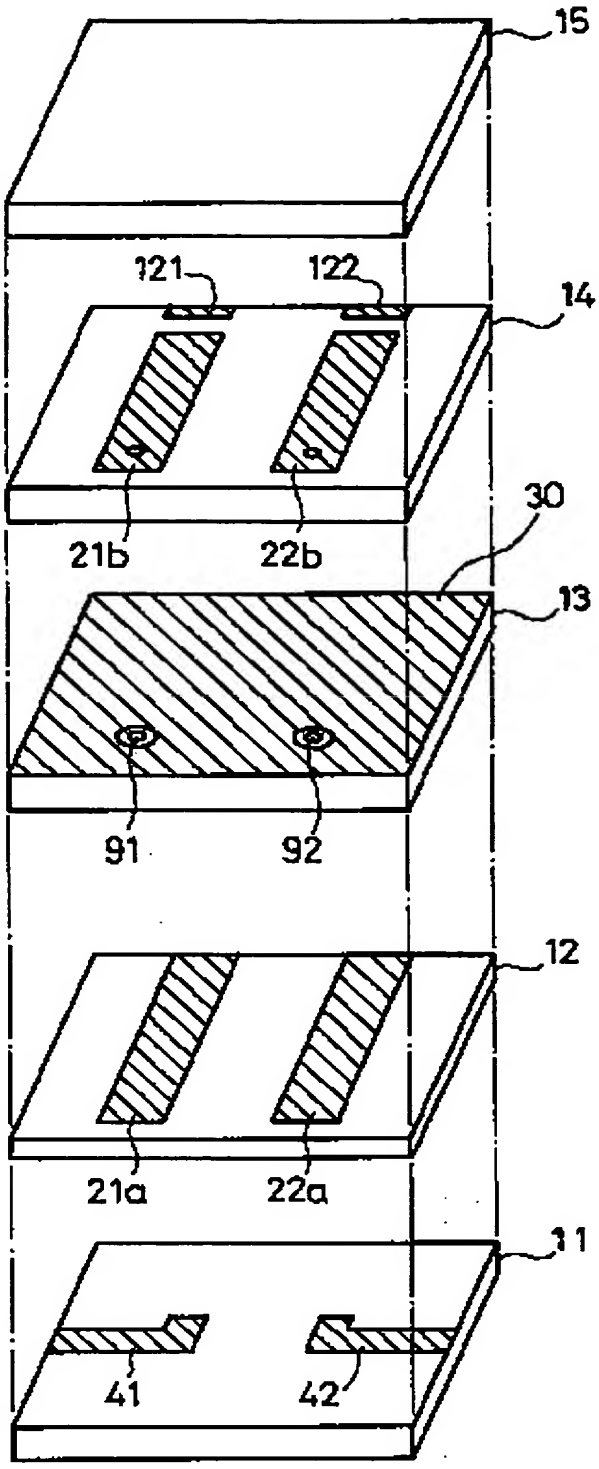
CLAIMS

[Claim(s)]
[Claim 1] The dielectric filter characterized by having the resonant-line way of the stripline mold more than two-layer [in which said resonant element was prepared up and down] in the dielectric filter of the stripline mold with which the resonant element is formed into the ground inter-electrode dielectric.
[Claim 2] The dielectric filter characterized by the ground inter-electrode dielectric layer thickness in which said resonant element is a resonant element of an one end short circuit mold, and the open end of said resonant element exists in a dielectric filter according to claim 1 being thinner than the ground inter-electrode dielectric layer thickness in which the short circuit edge of said resonant element exists.
[Claim 3] The dielectric filter characterized by the dielectric constant of the ground inter-electrode dielectric layer in which the resonant-line way of at least one layer exists in a dielectric filter according to claim 1 or 2 among the resonant-line ways more than two-layer [which constitutes said resonant element] being smaller than the dielectric constant of the ground inter-electrode dielectric layer in which the resonant-line way of other layers exists.

[Translation done.]

FIG.1



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the dielectric filter used for the high frequency circuit filter used for high frequency circuit wireless devices, such as portable telephone, an antenna duplexer, etc. about a dielectric filter.
[0002]
[Description of the Prior Art] Drawing 18 and drawing 19 are the ** type development views and perspective views of the dielectric filter which this invention persons invented, respectively.
[0003] In this dielectric filter, as shown in drawing 18 , the electrode 42 for an output which laps with a part of resonant element 22 of the output side in which the electrode 41 for an input which laps with a part of resonant element 21 of the input side in which the end section carries out a postscript, and the end section carry out a postscript is first formed on a dielectric layer 11. The end section forms the resonant elements 21 and 22 which consist of a quarter-wave length mold stripline resonator electrically connected to the ground electrode 70 which carries out a postscript with predetermined spacing on the dielectric layer 16 by which a laminating is carried out on a dielectric layer 11. Furthermore, the end section is electrically connected to the ground electrode 70, and the other end forms predetermined distance detached building ********** 21 and 22 and the electrodes 121 and 122 with which it counters on a dielectric layer 16 from the open end of resonant elements 21 and 22, and inductive coupling of between resonant elements 21 and 22 is carried out. The laminating of the dielectric layer 15 is carried out on a dielectric layer 16, and the layered product 100 as calcinated after that and shown in drawing 19 is formed.
[0004] Next, as shown in drawing 19 , the ground electrode 70 is formed in the side face and rear face except the input terminal section 61 and the output terminal section 62 at the front face of a layered product 100, and a list. The input terminal 51 which is electrically insulated from the ground electrode 70 in the input terminal section 61 formed in the side face and rear face of a layered product 100, and is electrically connected to the electrode 41 for an input, It insulated from the ground electrode 70 electrically in the output terminal section 62 formed in the side face and rear face of a layered product 100, and the output terminal 52 electrically connected to the electrode 42 for an output was formed and constituted.
[0005]
[Problem(s) to be Solved by the Invention] However, although it is required increasingly strongly that the demand of a miniaturization should have become strong, the dielectric filter used for the interior along with it should also be miniaturized especially in the portable telephone terminal with which such a dielectric filter is used, and the occupancy area should be made small Since resonant elements 21 and 22 needed to have about 1 / four waves of die length in the same side in the dielectric filter of the structure mentioned above, for example, respectively, it was difficult to make the occupancy area small.
[0006] Therefore, it is miniaturized and the purpose of this invention is to offer a dielectric filter with a small occupancy area when mounting.
[0007]
[Means for Solving the Problem] According to this invention, in the dielectric filter of the stripline mold with which the resonant element is formed into the ground inter-electrode dielectric, the dielectric filter characterized by having the resonant-line way of the stripline mold more than two-layer [in which said resonant element was prepared up and down] is obtained.
[0008]
[Function] In this invention, since it has the resonant-line way of the stripline mold more than two-layer [in which the

resonant element was prepared up and down], occupancy area by the resonant element can be made small, consequently occupancy area of a dielectric filter can be made small.
[0009] The connection between the upper resonant-line way and a lower layer resonant-line way May go with the electrode for connection prepared in the side face of a dielectric filter, and the beer hall which was prepared into the dielectric layer between the upper resonant-line way and a lower layer resonant-line way, and filled up the interior with the conductor may perform, and Although it is prepared into the dielectric layer between the upper resonant-line way and a lower layer resonant-line way and the interior is not filled up with a conductor, the through hole which prepared the conductor in the side face may perform.
[0010] If the upper resonant-line way and a lower layer resonant-line way are connected by the beer hall or the through hole, since the resonant element constituted by these will not be exposed to the exterior of a dielectric filter, effect from the outside to a filter shape can be made small. moreover, when connection between the upper resonant-line way and a lower layer resonant-line way is made with the electrode for connection prepared in the side face of a dielectric filter Since the front end section of the upper resonant-line way and the front end section of a lower layer resonant-line way are made exposed to the side face of a dielectric filter, lay length in which the resonant-line way of a dielectric layer in which an upper resonant-line way and a lower layer upper resonant-line way are established, respectively extends can be shortened.
[0011] The resonant element of the one end short circuit mold which short-circuited one end and opened the other end wide as a resonant element, and the resonant element of the both-ends open sand mold which opened both ends wide can be used. Moreover, as a dielectric filter, it is applicable to the filter of the COM line mold which has arranged the short circuit edge in the same direction, and the filter of the INTADEJITARU mold which has arranged the short circuit edge by turns.
[0012] By making thinner than the ground inter-electrode dielectric layer thickness in which the short circuit edge of a resonant element exists ground inter-electrode dielectric layer thickness in which the open end of a resonant element exists as a resonant element in using the resonant element of an one end short circuit mold The open end part of a resonant element becomes more close to a ground, electrostatic capacity will be formed between the open end part of a resonant element, and a ground electrode, and it will be added to the electrostatic capacity of a parallel resonant circuit when this electrostatic capacity also carries out equivalent transformation of the resonant element. Therefore, about resonance frequency, the inductance of the same, then a parallel resonant circuit will be small, it will end, as a result, the die length of a resonant element also becomes short, and the die length of a dielectric filter also becomes short.
[0013] Moreover, since a dielectric constant can enlarge association between the resonant-line ways which exist in a small dielectric layer by making smaller than the dielectric constant of the ground inter-electrode dielectric layer in which the resonant-line way of other layers exists the dielectric constant of the ground inter-electrode dielectric layer in which the resonant-line way of at least one layer exists among the resonant-line ways more than two-layer [which constitutes a resonant element], the degree of freedom of a design can be increased.
[0014] Furthermore, since the characteristic impedance of the resonant-line way of the part near an open end and the characteristic impedance of the resonant-line way of the part near a short circuit edge can be greatly changed by changing the dielectric constant of the dielectric layer in which an open end exists, and the dielectric constant of the dielectric with which a short circuit edge exists when using the resonant element of an one end short circuit mold as a resonant element, the spurious characteristics of a dielectric filter are improvable.
[0015] Moreover, this invention can be applied also to a trap filter and the resonant element in this case is constituted by the inductance component constituted by the resonant-line way more than two-layer, and the capacity component formed in the gap of a resonant-line way and an input terminal.
[0016]
[Example] Hereafter, it explains with reference to the drawing of attachment of the example of this invention.
[0017] Drawing 1 is the ** type development view of the 1st example of this invention, drawing 2 is the perspective view of this example, and drawing 3 is X-X-ray sectional view of drawing 2 .
[0018] The electrode 41 for an input which laps with a part of resonant-line way 21a of the input side in which the end section carries out a postscript, and the end section form the electrode 42 for an output which laps with a part of resonant-line way 22a of the output side which carries out a postscript on a dielectric layer 11.
[0019] On the dielectric layer 12 by which a laminating is carried out on a dielectric layer 11, the end section The (back end section) Resonant-line way 21a and the end section (back end section) which are electrically connected to the ground electrode 70 which carries out a postscript, and constitute a part of quarter-wave length mold stripline resonant element of an input side are electrically connected to the ground electrode 70 which carries out a postscript. A part of quarter-wave length mold stripline resonant element of an output side Resonant-line way 21b to constitute is formed

with predetermined spacing.
[0020] The internal ground electrode 30 is formed on the dielectric layer 13 by which a laminating is carried out on a dielectric layer 12. In addition, it insulates with the internal ground electrode 30 electrically, respectively, the beer hall 92 for connecting the beer hall 91 for connecting to a dielectric layer 13 resonant-line way 21a and resonant-line way 21b which carries out a postscript, resonant-line way 22a, and resonant-line way 22b that carries out a postscript is formed, and it fills up with a conductor in these beer halls 91 and 92.
[0021] Resonant-line way 22b which constitutes a part of resonant-line way 21b which constitutes a part of quarter-wave length mold stripline resonant element of an input side, and quarter-wave length mold stripline resonant element of an output side is formed with predetermined spacing on the dielectric layer 14 by which a laminating is carried out on a dielectric layer 13. The back end sections of resonant-line way 21b and resonant-line way 22b are the open end of the quarter-wave length mold stripline resonant element of an input side, and the open end of the quarter-wave length mold stripline resonant element of an output side, respectively.
[0022] The beer hall 91 where the front end section of resonant-line way 21a prepared on the front end section of resonant-line way 21b prepared on the dielectric layer 14 and a dielectric layer 12 was prepared in the dielectric layer 13, and the interior was filled up with the conductor connects, and the quarter-wave length mold stripline resonant element of an input side is constituted. The beer hall 92 where the front end section of resonant-line way 22a prepared on the front end section of resonant-line way 22b prepared on the dielectric layer 14 and a dielectric layer 12 was prepared in the dielectric layer 13, and the interior was filled up with the conductor connects, and the quarter-wave length mold stripline resonant element of an output side is constituted.
[0023] Furthermore, the end section is electrically connected to the ground electrode 70, and the other end forms the predetermined distance detached building ****** tracks 21 and 22 and the electrodes 121 and 122 with which it counters, respectively on a dielectric layer 14 from the open end of the resonant-line ways 21b and 22b, and inductive coupling of between the resonant element of an input side and the resonant elements of an output side is carried out.
[0024] The laminating of the dielectric layer 15 by which the ground electrode 70 is formed on a front face on a dielectric layer 14 is carried out, dielectric layers 11, 12, 13, 14, and 15 are constituted in one, it calcinates after that, and a layered product 100 is formed.
[0025] Next, as shown in drawing 2 , the ground electrode 70 is formed in the side face and rear face except the input terminal section 61 and the output terminal section 62 at the front face of a layered product 100, and a list. The input terminal 51 which is electrically insulated from the ground electrode 70 and the internal ground electrode 30 in the input terminal section 61 formed in the side face and rear face of a layered product 100, and is electrically connected to the electrode 41 for an input, It insulates from the ground electrode 70 and the internal ground electrode 30 electrically in the output terminal section 62 formed in the side face and rear face of a layered product 100; and the output terminal 52 electrically connected to the electrode 42 for an output is formed.
[0026] In the dielectric filter of this example constituted as mentioned above, since a quarter-wave length mold resonant element is constituted by the resonant-line ways 21a and 22a on a dielectric layer 12, and the resonant-line ways 21b and 22b on a dielectric layer 14, respectively, extension lay length a of the resonant-line ways 21a, 22a, 21b, and 22b of a dielectric filter becomes short, therefore it can make small occupancy area at the time of mounting. Moreover, in this example, since it has connected, respectively by the beer halls 91 and 92 where the resonant-line ways 21a and 22a on a dielectric layer 12 and the resonant-line ways 21b and 22b on a dielectric layer 14 were formed in the dielectric layer 13, and the interior was filled up with the conductor and the resonant element constituted by these is not exposed to the exterior of a dielectric filter, effect from the outside to a filter shape can be made small.
[0027] Next, the manufacture approach of the dielectric filter of the 1st example of this invention is explained.
[0028] This dielectric filter from building the conductor in a beer hall 91 and 92 in the resonant-line ways 21a, 22a, 21b, and 22b, electrodes 121 and 122, the electrode 41 for an input and the electrode 42 for an output, and internal ground electrode 30 list in a dielectric completely It is desirable to use the low thing of specific resistance with little loss for the conductor in a beer hall 91 and 92 at the resonant-line ways 21a, 22a, 21b, and 22b, electrodes 121 and 122, the electrode 41 for an input and the electrode 42 for an output, and internal ground electrode 30 list. Ag system of low resistance, Or it is desirable to use the conductor of Cu system.
[0029] The ceramic dielectric with which the miniaturization of dielectric constant epsilongamma is attained high by dependability as a dielectric to be used since it is large is desirable.
[0030] Moreover, after applying conductive paste to the Plastic solid of ceramic powder and forming an electrode pattern as the manufacture approach, it is desirable to unite with a ceramic dielectric, where it carried out the laminating, and it calcinated each Plastic solid further, it carried out eburnation and the laminating of the conductor is carried out to the interior.

[0031] To use the conductor of Ag system or Cu system, the melting point of those conductors is low and carrying out coincidence baking with the usual dielectric materials needs to use the dielectric materials which may be calcinated at temperature lower than those melting points (1100 degrees C or less) from a difficult place. Moreover, dielectric materials with which the temperature characteristic (temperature coefficient) of the resonance frequency of the parallel resonant circuit formed becomes [degree C] in **50 ppm /or less on the character of the device as a microwave filter are desirable. As such dielectric materials, it is cordierite system glass powder and TiO2, for example. Powder and Nd2 Ti 2O7 The thing of textile glass yarn, such as mixture with powder, BaO-TiO2-Re2 O3-Bi 2O3 There are what added some glass formation component and glass powder to the system presentation (Re: rare earth component), and a thing which added some glass powder to barium-oxide-titanium oxide-oxidization neodium system dielectric MAG constituent powder.

[0032] As an example, it is BaO-TiO2-Nd2 23-Bi 2O3. It is ZnO-B2 O3-SiO2 to the powder of a system presentation. System glass powder was mixed and mixed powder was obtained. Subsequently, the solvent of an acrylic organic binder, a plasticizer, toluene, and an alcoholic system was added to this mixed powder, and it fully mixed with the alumina ball, and considered as the slurry. And the green sheet with a thickness of 0.2mm - 0.5mm was created with the doctor blade method using this slurry.

[0033] Next, the conductor pattern shown in drawing 1 by using a silver paste as conductive paste was printed, respectively, subsequently, after piling up and carrying out the laminating of the required green sheet so that it may become the structure of drawing 1 in piles in order to adjust the thickness of the green sheet with which these conductor patterns were printed, in the case of the 1st example of the above, it calcinated at 900 degrees C, and it obtained the layered product 100. Specific-inductive-capacity epsilonr of the dielectric after baking It was 80.

[0034] The top face of the layered product 100 constituted as mentioned above, i.e., the field corresponding to all front faces of a dielectric layer 15, And the ground electrode 70 which consists of a silver electrode as shown in the side face and base except the input terminal section 61 and the output terminal section 62 at drawing 2 is printed. Furthermore, insulate from the ground electrode 70 electrically, and the silver electrode electrically connected to the electrode 41 for an input and the electrode 42 for an output at each ** is printed as an input terminal 51 and an output terminal 52 in the input terminal section 61 and the output terminal section 62. The printed electrode could be burned at 850 degrees C, and the dielectric filter of this example was formed.

[0035] In this example, it is [the thickness of the dielectric layer B in which the short circuit side of the thickness of the dielectric layer A in which the open end of a resonant element exists, and a resonant element exists] the same, and there was 2mm, respectively. Moreover, extension lay length a of the resonant-line ways 21a, 22a, 21b, and 22b of a dielectric filter was 3.5mm, the width of face b of a dielectric filter was 5mm, and center frequency was 1800MHz.

[0036] For the comparison, drawing 18 and the dielectric filter shown in 19 were formed by the same approach as this example using the ingredient used for this example. In this case, extension lay length a of the resonant element of a dielectric filter was [5mm and the thickness of the width of face b of 6mm and a dielectric filter] 2mm, and center frequency was 1800MHz. Although the thickness of the dielectric filter of the 1st example is thick if the dimension of the dielectric filter of this result and the 1st example is compared, extension lay length a of a resonant element is short, therefore it turns out that the occupancy area of the dielectric filter at the time of mounting is also small.

[0037] Next, the 2nd example of this invention is explained.

[0038] Drawing 4 is the ** type development view of the 2nd example of this invention, drawing 5 is the perspective view of this example, and drawing 6 is X-X-ray sectional view of drawing 5 .

[0039] Although the resonant element of the output side constituted in the 1st example of the above by the resonant element and the resonant-line ways 22a and 22b of an input side which are constituted by the resonant-line ways 21a and 21b was a resonant element of a single-sided short circuit mold In this example, although it differs from the 1st example in that the resonant element of the output side constituted by the resonant element and the resonant-line ways 22a and 22b of an input side which are constituted by the resonant-line ways 21a and 21b is a resonant element of a both-ends open sand mold, other configurations are the same as that of the 1st example of the above.

[0040] Also in this example, since a resonant element is constituted by the resonant-line ways 21a and 22a on a dielectric layer 12, and the resonant-line ways 21b and 22b on a dielectric layer 14, respectively, extension lay length a of the resonant-line ways 21a, 22a, 21b, and 22b of a dielectric filter becomes short, therefore it can make small occupancy area at the time of mounting. Moreover, also in this example, since it has connected, respectively by the beer halls 91 and 92 where the resonant-line ways 21a and 22a on a dielectric layer 12 and the resonant-line ways 21b and 22b on a dielectric layer 14 were formed in the dielectric layer 13, and the interior was filled up with the conductor and the resonant element constituted by these is not exposed to the exterior of a dielectric filter, effect from the outside to a filter shape can be made small.

[0041] Also in this example, the same thing as the ingredient used for the 1st example was used, and the dielectric filter was created by the same approach as the 1st example. Consequently, it is [dielectric layer thickness B in which the short circuit side of dielectric layer thickness A in which the open end of a resonant element exists and a resonant element exists] the same, and there was 2mm, respectively. Moreover, extension lay length a of the resonant-line ways 21a, 22a, 21b, and 22b of a dielectric filter was 3.5mm, the width of face b of a dielectric filter was 5mm, and center frequency was 900MHz.
[0042] Next, the 3rd example of this invention is explained.
[0043] Drawing 7 is the ** type development view of the 3rd example of this invention, drawing 8 is the perspective view of this example, and drawing 9 is X-X-ray sectional view of drawing 8 .
[0044] Thickness of the dielectric layer B in which the short circuit side of the thickness of the dielectric layer A in which the open end of a resonant element exists, and a resonant element exists in the 1st example of the above is made the same. Furthermore, although it connected, respectively by the beer halls 91 and 92 where the resonant-line ways 21a and 22a on a dielectric layer 12 and the resonant-line ways 21b and 22b on a dielectric layer 14 were formed in the dielectric layer 13, and the interior was filled up with the conductor While making thickness of the dielectric layer A in which the open end of a resonant element exists thinner than the thickness of the dielectric layer B in which the short circuit side of a resonant element exists in this example, resonant-line way 21a on a dielectric layer 12, Although the point connected, respectively with the electrodes 81 and 82 for connection which established 22a and the resonant-line ways 21b and 22b on a dielectric layer 14 in the side face of a layered product 100 differs from the 1st example, other configurations are the same as that of the 1st example of the above.
[0045] In this example, by making thinner than the thickness of the dielectric layer B in which the short circuit side of a resonant element exists thickness of the dielectric layer A in which the open end of a resonant element exists, the open end part of a resonant element becomes more close to a ground, electrostatic capacity will be formed between the open end part of a resonant element, and a ground electrode, and it will be added to the electrostatic capacity of a parallel resonant circuit when this electrostatic capacity also carries out equivalent transformation of the resonant element. Therefore, about resonance frequency, the inductance of the same, then a parallel resonant circuit will be small, it will end, as a result, the die length of a resonant element also becomes short, and the die length of a dielectric filter also becomes short.
[0046] In this example Moreover, resonant-line way 21b on the resonant-line ways 21a and 22a on a dielectric layer 12, and a dielectric layer 14, Since it has connected, respectively with the electrodes 81 and 82 for connection which prepared 22b in the side face of a layered product 100 Since the front end section of the resonant-line ways 21a and 22a on a dielectric layer 12 and the front end section of the resonant-line ways 21b and 22b on a dielectric layer 14 are made exposed to the side face of a dielectric filter Lay length in which the resonant-line way of dielectric layers 12 and 14 in which the resonant-line ways 21a and 22a and the resonant-line ways 21b and 22b are established extends can be shortened.
[0047] In order to avoid that these electrodes 81 and 82 for connection are grounded, the front end section of a dielectric layer 13 is not making the internal ground electrode 13 prepared on a dielectric layer 13 extend in this example, since the electrodes 81 and 82 for connection for connecting the resonant-line ways 21a and 22a on a dielectric layer 12 and the resonant-line ways 21b and 22b on a dielectric layer 14, respectively are formed in the last side face of a layered product 100.
[0048] Next, the manufacture approach of the dielectric filter of this example is explained. The conductor pattern shown in drawing 7 by using a silver paste as conductive paste also in this example using the green sheet used in the 1st example was printed, respectively, subsequently to these, after carrying out the laminating of the green sheet required in order to adjust the thickness of the green sheet with which the conductor pattern was printed so that it may become the structure of drawing 7 in piles, it calcinated at 900 degrees C and the layered product 100 was formed.
[0049] The top face of the layered product 100 constituted as mentioned above, i.e., the field corresponding to all front faces of a dielectric layer 15, And the ground electrode 70 which consists of a silver electrode as shown in the left and right laterals except the input terminal section 61 and the output terminal section 62, a back side face, and a base at drawing 2 is printed. Moreover, insulate from the ground electrode 70 electrically, and the silver electrode electrically connected to the electrode 41 for an input and the electrode 42 for an output at each ** is printed as an input terminal 51 and an output terminal 52 in the input terminal section 61 and the output terminal section 62. Furthermore, the electrodes 81 and 82 for connection which connect the resonant-line ways 21a and 22a on a dielectric layer 12 and the resonant-line ways 21b and 22b on a dielectric layer 14, respectively were printed, the printed electrode could be burned on the last side face of a layered product 100 at 850 degrees C, and the dielectric filter of this example was formed in it.

[0050] In this example, it was [the thickness of the dielectric layer A in which the open end of a resonant element exists] thinner than the thickness of the dielectric layer B in which the short circuit side of a resonant element exists, and there was 1.6mm 0.5mm, respectively. Moreover, extension lay length a of the resonant-line ways 21a, 22a, 21b, and 22b of a dielectric filter was 2.5mm, the width of face b of a dielectric filter was 5mm, and center frequency was 1800MHz.
[0051] In this example, extension lay length a of the resonant element of a dielectric filter could be made shorter than the 1st example, and the dielectric filter miniaturized more was obtained.
[0052] Next, the 4th example of this invention is explained.
[0053] Drawing 10 is the ** type development view of the 4th example of this invention, drawing 11 is the perspective view of this example, and drawing 12 is X-X-ray sectional view of drawing 11 .
[0054] Thickness of the dielectric layer B in which the short circuit side of the thickness of the dielectric layer A in which the open end of a resonant element exists, and a resonant element exists in the 1st example of the above is made the same. Furthermore, on the dielectric layer 14, in addition to the resonant-line ways 21b and 22b, the end section was electrically connected to the ground electrode 70, and the other end formed the predetermined distance detached building ****** tracks 21 and 22 and the electrodes 121 and 122 with which it counters, respectively from the open end of the resonant-line ways 21b and 22b, but Although it differs from the 1st example in that did not form electrodes 121 and 122 on the dielectric layer 14, but only the resonant-line ways 21b and 22b were formed while making thickness of the dielectric layer A in which the open end of a resonant element exists thinner than the thickness of the dielectric layer B in which the short circuit side of a resonant element exists in this example Other configurations are the same as that of the 1st example of the above.
[0055] Also in this example, by making thinner than the thickness of the dielectric layer B in which the short circuit side of a resonant element exists thickness of the dielectric layer A in which the open end of a resonant element exists, the open end part of a resonant element becomes more close to a ground, electrostatic capacity will be formed between the open end part of a resonant element, and a ground electrode, and it will be added to the electrostatic capacity of a parallel resonant circuit when this electrostatic capacity also carries out equivalent transformation of the resonant element. Therefore, about resonance frequency, the inductance of the same, then a parallel resonant circuit will be small, it will end, as a result, the die length of a resonant element also becomes short, and the die length of a dielectric filter also becomes short.
[0056] Also in this example, the same thing as the ingredient used for the 1st example was used, and the dielectric filter was created by the same approach as the 1st example. Consequently, the thickness of the dielectric layer A in which the open end of a resonant element exists was 0.5mm, and the thickness of the dielectric layer B in which the short circuit side of a resonant element exists was 1.6mm. Moreover, extension lay length a of the resonant-line ways 21a, 22a, 21b, and 22b of a dielectric filter was 3.0mm, the width of face b of a dielectric filter was 5mm, and center frequency was 1800MHz.
[0057] In this example, extension lay length a of the resonant element of a dielectric filter could be made shorter than the 1st example, and the dielectric filter miniaturized more was obtained.
[0058] In this example Moreover, resonant-line way 21b on the resonant-line ways 21a and 22a on a dielectric layer 12, and a dielectric layer 14, Although extension lay length a of the resonant element of a dielectric filter became long a little rather than the 3rd example since it had connected, respectively by the beer halls 91 and 92 where 22b was prepared in the dielectric layer 13, and the interior was filled up with the conductor Since the resonant element constituted by the resonant-line ways 21a, 22a, 21b, and 22b and beer halls 91 and 92 is not exposed to the exterior of a dielectric filter, effect from the outside to a filter shape can be made small.
[0059] Next, the 5th example of this invention is explained.
[0060] Although the structure of the dielectric filter of this example is the same as drawing 7 and the 3rd example explained with reference to 8 and 9, the used dielectric materials differ somewhat.
[0061] Namely, although the point which makes thickness of the dielectric layer A in which the open end of a resonant element exists thinner than the thickness of the dielectric layer B in which the short circuit side of a resonant element exists also in this example is the same as the 3rd example BaO-TiO2-Nd2 23-Bi 2O3 which are the dielectric materials used for the 3rd example at the dielectric layer A in which the open end of a resonant element exists, and the same ingredient It is ZnO-B2 O3-SiO2 to the powder of a system presentation. The mixed powder which mixed system glass powder In the dielectric layer B in which the short circuit edge of a resonant element exists although the used green sheet is used, it is ZnO-B2 O3-SiO2 to the powder of a BaO-TiO2-ZnO system presentation. The green sheet using the mixed powder which mixed system glass is used. The point which makes small the dielectric constant of the dielectric layer B in which the short circuit edge of a resonant element exists rather than the dielectric constant of the dielectric

layer A in which the open end of a resonant element exists differs from the 3rd example.
[0062] In addition, in using different dielectric materials in one dielectric filter like this example, in order to avoid the camber and knee after baking, it is desirable to make it contraction at the time of baking of the green sheet used for the green sheet used for a dielectric layer A and a dielectric layer B not differ greatly.
[0063] Next, the manufacture approach of the dielectric filter of this example is explained. The conductor pattern shown in drawing 7 by using a silver paste as conductive paste in this example using two kinds of green sheets mentioned above was printed, respectively, subsequently to these, after carrying out the laminating of the green sheet required in order to adjust the thickness of the green sheet with which the conductor pattern was printed so that it may become the structure of drawing 7 in piles, it calcinated at 900 degrees C and the layered product 100 was formed. The specific inductive capacity of the dielectric layer A after baking was 80, the specific inductive capacity of a dielectric layer B was 32, and its dielectric constant of the dielectric layer B in which the short circuit edge of a resonant element exists was smaller than the dielectric constant of the dielectric layer A in which the open end of a resonant element exists.
[0064] Thus, in the formed dielectric filter, the thickness of the dielectric layer A in which the open end of a resonant element exists was 0.5mm, and the thickness of the dielectric layer B in which the short circuit side of a resonant element exists was 1.6mm. Moreover, extension lay length a of the resonant-line ways 21a, 22a, 21b, and 22b of a dielectric filter was 3.0mm, the width of face b of a dielectric filter was 5mm, and center frequency was 1800MHz.
[0065] Also in this example, extension lay length a of the resonant element of a dielectric filter could be shortened, and the dielectric filter miniaturized more was obtained.
[0066] Moreover, in this example, since the dielectric constant of the dielectric layer B in which the short circuit edge of a resonant element exists was made small, association between resonant elements became strong, and the dielectric filter broadband-ized more was obtained.
[0067] Furthermore, in this example, the dielectric layer A in which the open end of a resonant element exists was able to have the large dielectric constant, and the dielectric layer B in which the short circuit edge of a resonant element exists to a thing with thin dielectric layer thickness had the small dielectric constant, and since dielectric layer thickness was thick, the characteristic impedance by the side of the open end of a resonant element became smaller than the characteristic impedance of short circuit one end, and has also improved the spurious characteristics of a dielectric filter.
[0068] Next, the 6th example of this invention is explained. In the above 1st thru/or the 4th example, although the case where this invention was applied to the band pass filter using association between resonant elements was explained, the case where it applies to a dielectric trap filter in this example is explained.
[0069] Drawing 13 is the ** type development view of the 6th example of this invention, drawing 14 is the perspective view of this example, and drawing 15 is X-X-ray sectional view of drawing 14 .
[0070] The input terminal 53 which constitutes a capacity component on both sides of resonant-line way 23a and resonant-line way 23a which constitute a part of inductance component, and a dielectric layer is formed on a dielectric layer 12. In addition, the back end section of resonant-line way 23a is connected with the back end section of resonant-line way 23b which carries out a postscript with the conductor in the beer hall 93 which carries out a postscript.
[0071] The internal ground electrode 30 is formed on the dielectric layer 13 by which a laminating is carried out on a dielectric layer 12. In addition, it insulates with the internal ground electrode 30 electrically, the beer hall 93 for connecting to a dielectric layer 13 resonant-line way 23a and resonant-line way 23b which carries out a postscript is formed, and it fills up with a conductor in this beer hall 93.
[0072] Resonant-line way 23b which forms an inductance component with resonant-line way 23a on the dielectric layer 14 by which a laminating is carried out on a dielectric layer 13 is formed. The back end section of resonant-line way 23b is connected with the back end section of resonant-line way 23a by the conductor in a beer hall 93, and it connects with the ground electrode 70 in which the front end section of resonant-line way 23b carries out a postscript.
[0073] The laminating of the dielectric layer 15 by which the ground electrode 70 is formed on a front face on a dielectric layer 14 is carried out, dielectric layers 12, 13, 14, and 15 are constituted in one, it calcinates after that, and a layered product 100 is formed.
[0074] Next, as shown in drawing 14 and drawing 15 , the ground electrode 70 is formed in the side face except a front face, and the rear face except the input terminal section at the top face of a layered product 100, and a list. The ground electrode 71 list connected with the ground electrode 70, the front end section of resonant element 23b, and the front end section of the internal ground electrode 30, respectively insulates with the ground electrode 70 electrically, and the input terminal 54 electrically connected to an input terminal 53 is formed in the front face of a layered product 100. It insulates with the ground electrode 70 electrically at the rear face of a layered product 100, and the input terminal 55

electrically connected to an input terminal 54 is formed.
[0075] Drawing 16 shows the representative circuit schematic of the dielectric trap filter of this example. The inductance component 212 is constituted by the resonant-line ways 23a and 23b, and the capacity component 211 is constituted by the gap of the front end section of resonant-line way 23a, and an input terminal 53. Thus, the constituted filter can show frequency characteristics as shown in drawing 17 , and can attenuate specific signalling frequency greatly by adding this filter all over a circuit.
[0076] In the dielectric trap filter of this example constituted as mentioned above, since the inductance component 212 is constituted by resonant-line way 23a on a dielectric layer 12, and resonant-line way 23b on a dielectric layer 14, the extension lay length of the resonant-line ways 23a and 23b of a dielectric filter becomes short, therefore it can make small occupancy area at the time of mounting. Moreover, also in this example, since it has connected, respectively by the beer hall 93 where resonant-line way 23a on a dielectric layer 12 and resonant-line way 23b on a dielectric layer 14 were prepared in the dielectric layer 13, and the interior was filled up with the conductor and the resonant-line way constituted by these is not exposed to the exterior of a dielectric filter, effect from the outside to a filter shape can be made small.
[0077] Next, the manufacture approach of the dielectric filter of this example is explained. The conductor pattern shown in drawing 13 by using a silver paste as conductive paste also in this example using the green sheet used in the 1st example was printed, respectively, subsequently to these, after carrying out the laminating of the green sheet required in order to adjust the thickness of the green sheet with which the conductor pattern was printed so that it may become the structure of drawing 13 in piles, it calcinated at 900 degrees C and the layered product 100 was formed.
[0078] The ground electrode 70 which consists of a silver electrode as shown at drawing 14 and drawing 15 at the side face except a front face and the rear face except the input terminal section is printed in the top face of the layered product 100 constituted as mentioned above, and a list. In moreover, the front face of a layered product 100 The silver electrode connected with the ground electrode 70, the front end section of resonant element 23b, and the front end section of the internal ground electrode 30, respectively is electrically insulated with the ground electrode 70 by the list as a ground electrode 71, and the silver electrode electrically connected to an input terminal 53 is printed as an input terminal 54, respectively. It insulated with the ground electrode 70 electrically at the rear face of a layered product 100, and the electrode which printed the silver electrode electrically connected to an input terminal 54 as an input terminal 55, and was printed could be burned at 850 degrees C, and the dielectric filter of this example was formed.
[0079]
[Effect of the Invention] In this invention, since it has the resonant-line way of the stripline mold more than two-layer [in which the resonant element was prepared up and down], occupancy area by the resonant element can be made small, consequently occupancy area of a dielectric filter can be made small.
[0080] By making thinner than the ground inter-electrode dielectric layer thickness in which the short circuit edge of a resonant element exists ground inter-electrode dielectric layer thickness in which the open end of a resonant element exists as a resonant element in using the resonant element of an one end short circuit mold The open end part of a resonant element becomes more close to a ground, electrostatic capacity will be formed between the open end part of a resonant element, and a ground electrode, and it will be added to the electrostatic capacity of a parallel resonant circuit when this electrostatic capacity also carries out equivalent transformation of the resonant element. Therefore, about resonance frequency, the inductance of the same, then a parallel resonant circuit will be small, it will end, as a result, the die length of a resonant element also becomes short, and the die length of a dielectric filter also becomes short.
[0081] Moreover, since a dielectric constant can enlarge association between the resonant-line ways which exist in a small dielectric layer by making smaller than the dielectric constant of the ground inter-electrode dielectric layer in which the resonant-line way of other layers exists the dielectric constant of the ground inter-electrode dielectric layer in which the resonant-line way of at least one layer exists among the resonant-line ways more than two-layer [which constitutes a resonant element], the degree of freedom of a design can be increased.
[0082] Furthermore, since the characteristic impedance of the resonant-line way of the part near an open end and the characteristic impedance of the resonant-line way of the part near a short circuit edge can be greatly changed by changing the dielectric constant of the dielectric layer in which an open end exists, and the dielectric constant of the dielectric with which a short circuit edge exists when using the resonant element of an one end short circuit mold as a resonant element, the spurious characteristics of a dielectric filter are improvable.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
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3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] Especially this invention relates to the dielectric filter used for the high frequency circuit filter used for high frequency circuit wireless devices, such as portable telephone, an antenna duplexer, etc. about a dielectric filter.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a ** type development view for explaining the laminating mold dielectric filter of the 1st example of this invention.
[Drawing 2] It is a perspective view for explaining the laminating mold dielectric filter of the 1st example of this invention.
[Drawing 3] It is X-X-ray sectional view of drawing 2 .
[Drawing 4] It is a ** type development view for explaining the laminating mold dielectric filter of the 2nd example of this invention.
[Drawing 5] It is a perspective view for explaining the laminating mold dielectric filter of the 2nd example of this invention.
[Drawing 6] It is X-X-ray sectional view of drawing 5 .
[Drawing 7] It is a ** type development view for explaining the laminating mold dielectric filter of the 3rd and 5th examples of this invention.
[Drawing 8] It is a perspective view for explaining the laminating mold dielectric filter of the 3rd and 5th examples of this invention.
[Drawing 9] It is X-X-ray sectional view of drawing 8 .
[Drawing 10] It is a ** type development view for explaining the laminating mold dielectric filter of the 4th example of this invention.
[Drawing 11] It is a perspective view for explaining the laminating mold dielectric filter of the 4th example of this invention.
[Drawing 12] It is X-X-ray sectional view of drawing 11 .
[Drawing 13] It is a ** type development view for explaining the laminating mold dielectric filter of the 6th example of this invention.
[Drawing 14] It is a perspective view for explaining the laminating mold dielectric filter of the 6th example of this invention.
[Drawing 15] It is X-X-ray sectional view of drawing 14 .
[Drawing 16] It is the representative circuit schematic of the laminating mold dielectric filter of the 6th example of this invention.
[Drawing 17] It is drawing for explaining the frequency characteristics of the laminating mold dielectric filter of the 6th example of this invention.
[Drawing 18] It is a ** type development view for explaining the conventional dielectric filter which this invention persons invented.
[Drawing 19] It is a perspective view for explaining the conventional dielectric filter which this invention persons invented.
[Description of Notations]
11-16 -- Dielectric layer
21a, 21b, 22a, 22b, 23a, 23b -- Resonant-line way
21 22 -- Resonant element
30 -- Internal ground electrode
41 -- Electrode for an input
42 -- Electrode for an output
53-55 -- Output terminal

70 71 -- Ground electrode

[Translation done.]

* NOTICES *

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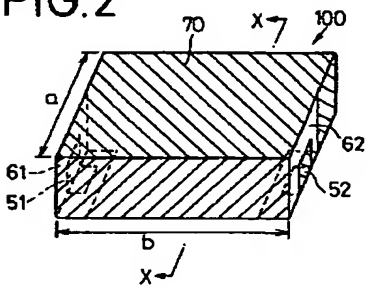
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

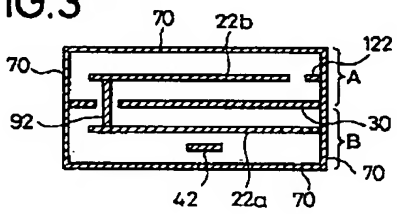
[Drawing 2]

FIG.2



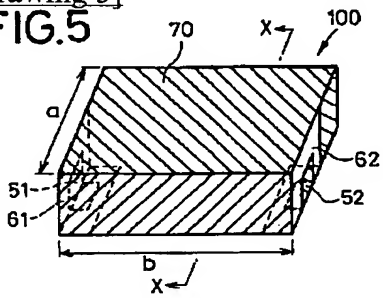
[Drawing 3]

FIG.3



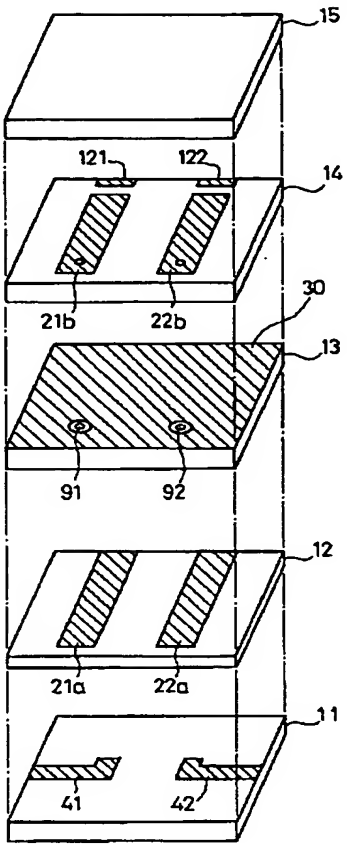
[Drawing 5]

FIG.5



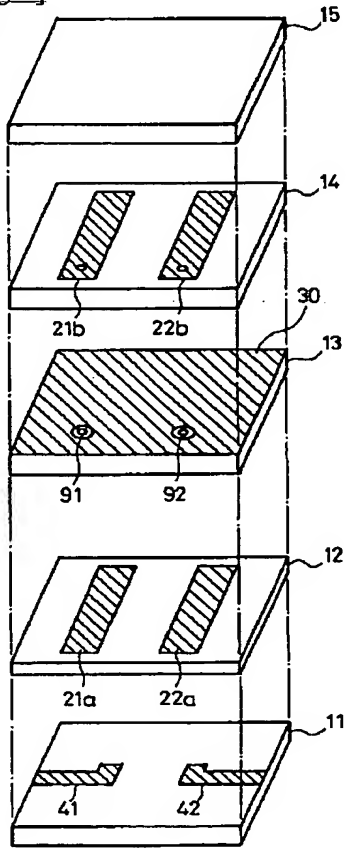
[Drawing 1]

FIG.1



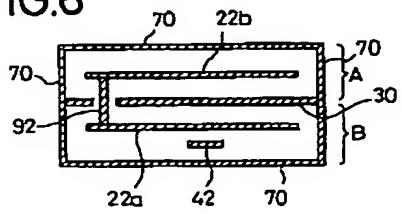
[Drawing 4]

FIG.4



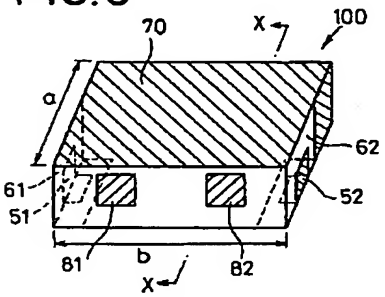
[Drawing 6]

FIG.6



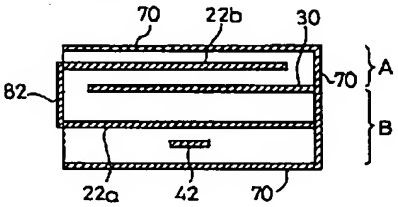
[Drawing 8]

FIG.8



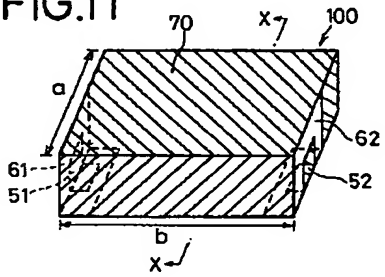
[Drawing 9]

FIG.9



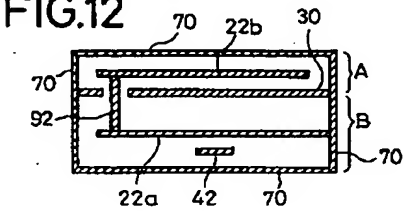
[Drawing 11]

FIG.11



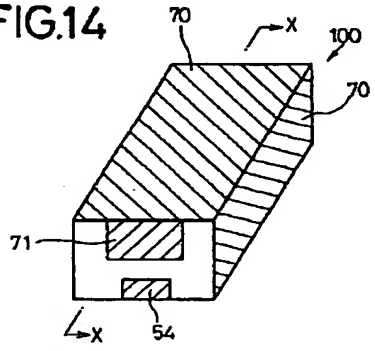
[Drawing 12]

FIG.12



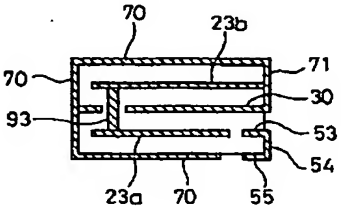
[Drawing 14]

FIG.14



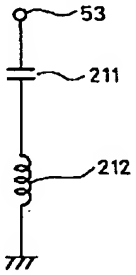
[Drawing 15]

FIG.15



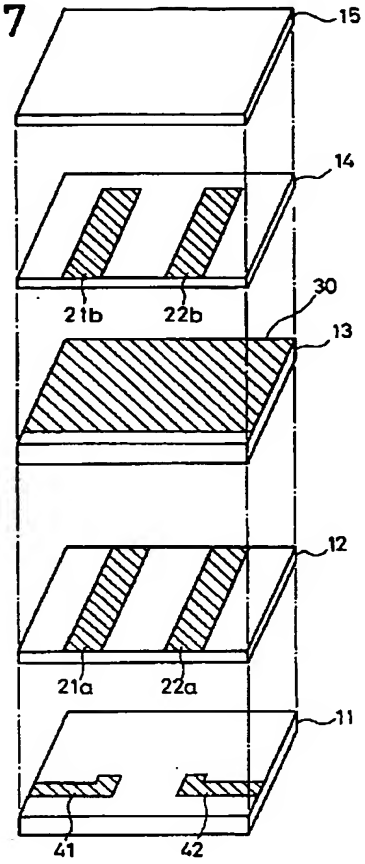
[Drawing 16]

FIG.16



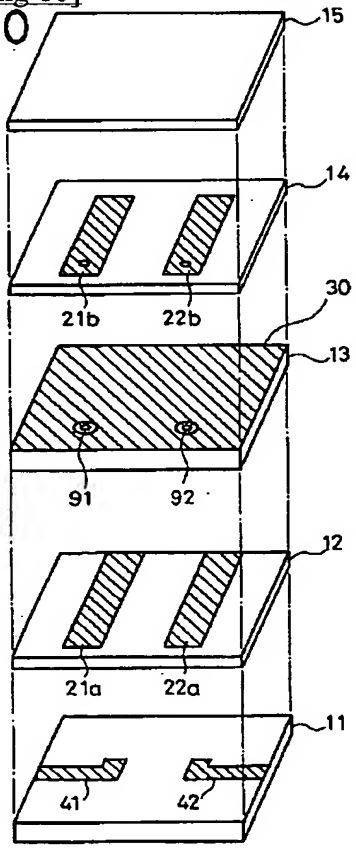
[Drawing 7]

FIG.7



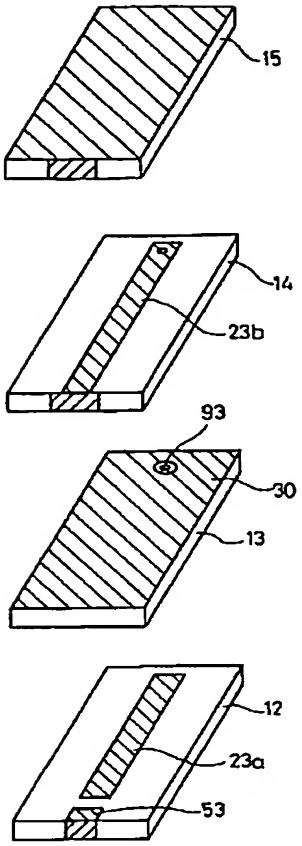
[Drawing 10]

FIG.10



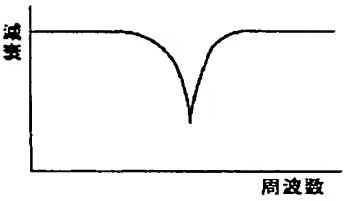
[Drawing 13]

FIG.13



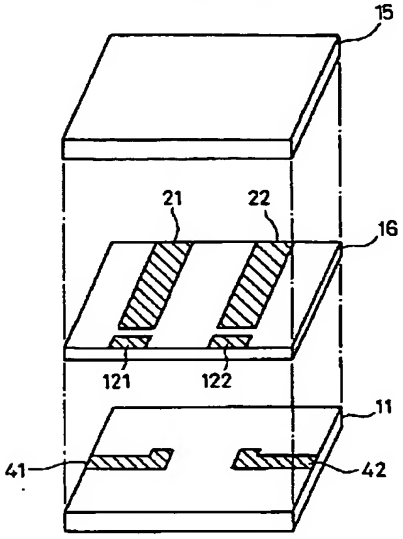
[Drawing 17]

FIG.17



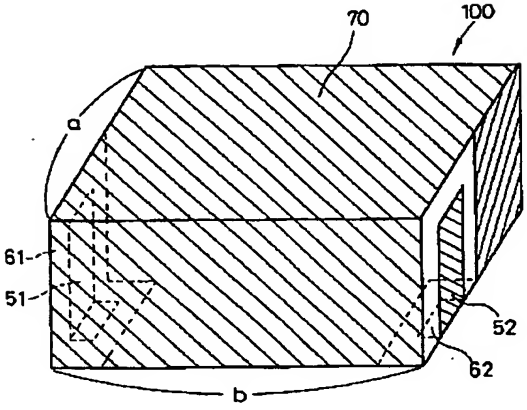
[Drawing 18]

FIG.18



[Drawing 19]

FIG.19



[Translation done.]